



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/628,582	07/31/2000	Christopher L. Hamlin	K35A0648	5196

26332 7590 12/31/2003

WESTERN DIGITAL CORP.
20511 LAKE FOREST DRIVE
C205 - INTELLECTUAL PROPERTY DEPARTMENT
LAKE FOREST, CA 92630

EXAMINER

BATES, KEVIN T

ART UNIT	PAPER NUMBER
----------	--------------

2155

DATE MAILED: 12/31/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/628,582

Applicant(s)

HAMLIN, CHRISTOPHER L.

Examiner

Kevin Bates

Art Unit

2155

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10-20-03.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

The response to the first office action has been received on October 20, 2003 and has been considered.

Response to Arguments

Applicant's arguments with respect to claims 1-11 have been considered but are moot in view of the new ground(s) of rejection.

Claims 1-11 are pending in this office action.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-5 and 7-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanai (5862403) in view of Frank, Jr. (6654195) and further in view of Thorson (6055618).

Regarding claim 1, Kanai discloses a network switch for resolving requests from a plurality of host initiators by scheduling access to a plurality of disk storage devices (Column 6, lines 12 – 21), the network switch comprising: (a) a switched fabric comprising a plurality of switching elements (Column 12, lines 14 – 27; Figure 5, elements 8 and 20; Column 17, line 65 – Column 18, line 3), each switching element comprising: a plurality of bi-directional switched fabric ports (Column 7, lines 60 – 62); and a control input connected to receive switch control data for selectively configuring

Art Unit: 2155

the switching element in order to interconnect the bi-directional switched fabric ports (Column 20, lines 17 – 20; Figure 17, Control Input); (b) a memory for storing a routing and scheduling program (Column 13, lines 59 – 61; Column 14, lines 4 – 6; lines 9 – 14; lines 18 – 20); and (c) a microprocessor (Column 13, lines 59 – 61), responsive to the requests (Column 13, line 66 – Column 14, line 2), for executing the steps of the routing and scheduling program to generate the switch control data to transmit scheduled requests through the bi-directional switched fabric ports (Column 14, lines 15 – 32), wherein: at least one of the plurality of switching elements comprises a disk storage interface for connecting to a selected one of the disk storage devices (Column 12, lines 52 – 58); the microprocessor for scheduling access to the plurality of disk storage devices through the disk storage interface (Column 14, lines 25 – 32), but Kanai does not explicitly mention that the disk storage interface receives scheduling data from the selected one of the storage devices; the memory for receiving the scheduling data via the bi-directional switched fabric ports of a selected number of the switching elements. Frank, Jr. teaches a method of receiving scheduling data from the storage devices through a disk storage interface and storing it in the main memory through a switch fabric (Column 2, lines 50 – 55). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Frank's teaching of sending scheduling data from the storage device in Kanai's storage system in order to help optimize it by providing the scheduler with more information about the status of the device and allow to make decisions based on that information (Column 3, lines 9 – 12; Column 1, lines 31 – 45). Kanai also does not explicitly indicate that the scheduling

data is processed according to a priority such that the selected switching elements transfer the scheduling data through the bi-directional switched fabric ports before transferring data associated with the scheduled requests. Thorson teaches in his switched network where the maintenance information that is described in column 1, line 24 as system configuration and hardware monitoring which can be considered as the data necessary for scheduling. In the abstract Thorson discloses that the scheduling data has higher priority than the normal traffic. Having maintenance data having priority means that it does not need its own physical network, which reduces the complexity of the system (Column 1, line 30) and the scheduling data still is always given access to the physical communication links (Column 9, line 30). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use Thorson teachings of enabling the scheduling data to be able to use the same communication lines as scheduled requests while making sure the scheduling data is always the highest priority of the system.

Regarding claim 7, Kanai discloses a method of resolving requests from a plurality of host initiators by scheduling access to a plurality of disk storage devices connected to a network switch (Column 6, lines 12 – 21), the network switch comprising a switched fabric comprising a plurality of switching elements (Column 12, lines 14 – 27; Figure 5, elements 8 and 20; Column 17, line 65 – Column 18, line 3), the method comprising the steps of transmitting data associated with the scheduled requests through the switching elements to the plurality of disk storage devices (Column 13, lines 59 – 61; Column 14, lines 4 – 6; lines 9 – 20), but Kanai does not explicitly mention

transmitting through the switching elements scheduling data from the plurality of disk storage devices to a memory; evaluating the scheduling data in order to schedule the requests from the host initiators. Frank, Jr. teaches a method of receiving scheduling data from the storage devices through a disk storage interface and storing it in the main memory through a switch fabric (Column 2, lines 50 – 55) and evaluating the scheduling data in order to schedule the requests from the host initiators (Column 3, lines 27 – 29). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Frank's teaching of sending scheduling data from the storage device in Kanai's storage system in order to help optimize it by providing the scheduler with more information about the status of the device and allow to make decisions based on that information (Column 3, lines 9 – 12; Column 1, lines 31 – 45). Kanai also does not explicitly indicate that the scheduling data is processed according to a priority such that the selected switching elements transfer the scheduling data through the bi-directional switched fabric ports before transferring data associated with the scheduled requests. Thorson teaches in his switched network where the maintenance information that is described in column 1, line 24 as system configuration and hardware monitoring which can be considered as the data necessary for scheduling. In the abstract Thorson discloses that the scheduling data has higher priority than the normal traffic. Having maintenance data having priority means that it does not need its own physical network, which reduces the complexity of the system (Column 1, line 30) and the scheduling data still is always given access to the physical communication links (Column 9, line 30). It would have been obvious to a person of ordinary skill in the art at the time the invention

was made to use Thorson teachings of enabling the scheduling data to be able to use the same communication lines as scheduled requests while making sure the scheduling data is always the highest priority of the system.

Regarding claim 2, Kanai discloses that the at least one switching element further comprises a disk storage device connected to the disk storage interface (Column 12, lines 52 – 58).

Regarding claims 3 and 8, Kanai does not explicitly indicate that each disk storage device comprises a disk and a head and the scheduling data comprises a radial location of the head relative to the disk within each disk storage device. Frank Jr. that each disk storage device comprises a disk and a head (Column 2, lines 25 – 26) and the scheduling data comprises a radial location of the head relative to the disk within each disk storage device teaches (Column 2, lines 38; lines 62 – 65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the radial location of the head in the scheduling data to help optimize the by providing the scheduler with more information about the status of the device and allow to make decisions based on that information (Column 3, lines 9 – 12; Column 1, lines 31 – 45).

Regarding claims 4 and 9, Kanai in view of Frank Jr. discloses that the scheduling data further comprises a circumferential location of the head relative to the disk within each disk drive (Column 2, line 62, the rotational position).

Regarding claims 5 and 11, Kanai does not explicitly indicate that the switching elements further comprise a plurality of virtual lanes, wherein: (a) at least one of the

virtual lanes is reserved for transferring data associated with the scheduled requests;

(b) at least one of the virtual lanes is reserved for transferring the scheduling data; and

(c) the virtual lane for transferring the scheduling data comprises a higher priority than the virtual lane for transferring the data associated with the scheduled requests.

Thorson teaches using virtual channels (Column 2, line 61 – Column 3, line 3) and allocating one of the virtual channels to the maintenance data (Column 3, lines 13 – 18), and that the reserved virtual channel is given a higher priority (Column 3, lines 18 – 20).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use Thorson's virtual lanes in Kanai's storage system for so that the scheduling data could be given priority over scheduled requests, and also to avoid deadlocks and reduce congestion for the scheduled requests (Column 2, lines 61 – 62).

Claims 6 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanai in view of Frank, Jr. and further in view of Thorson as applied to claims 1-5 and 7-10 above, and further in view of Darnell (6381647).

In regards to claims 6 and 11, Kanai discloses a storage system with the characteristics listed above and a master scheduler, which synchronizes the operations of all the interfaces, but it does not explicitly mention the protocol for scheduling data transmissions. Darnell teaches about a method of scheduling data in switched fabric. He discloses using isochronous frames that are initiated at a periodic rate to and from a master node or the acting control unit (Column 4, line 29). He also tells that the advantage of using these isochronous frames have many technical advantages, including using the bandwidth when it is no needed for the isochronous frames for

aperiodic frames such as the scheduled requests (Column 2, line 33). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use Darnell's improvement of transferring periodic scheduling data within a switched network on the storage system in order to achieve the synchronized operations mentioned in Kanai's system and keep the bandwidth available during the times where scheduled data is not needed to be sent for the scheduled requests.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U. S. Patent No. 6496899 issued to DeMoney.

U. S. Patent No. 6148414 issued to Brown.

U. S. Patent No. 5996014 issued to Uchihori.

U. S. Patent No. 5787482 issued to Chen.

U. S. Patent No. 5890202 issued to Tanaka.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Bates whose telephone number is (703) 605-0633. The examiner can normally be reached on 8 am - 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hosain Alam can be reached on (703) 308-6662. The fax phone number for the organization where this application or proceeding is assigned is (703) 746-7239.

Art Unit: 2155

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3800.

KB
December 15, 2003


HOSAIN ALAM
SUPERVISORY PATENT EXAMINER